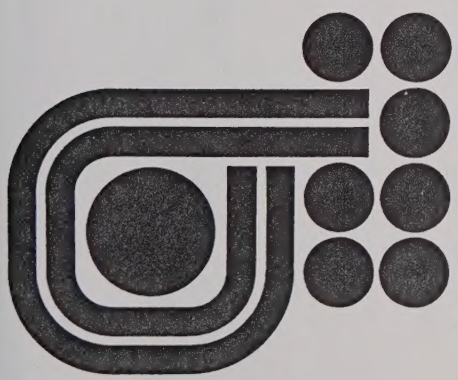
International Safety Analyzer Model 470

BioTek

~~SURGICAL DYNAMICS~~
VLH

INTERNATIONAL SAFETY ANALYZER
Model 470

OPERATOR'S MANUAL



BIO-TEK
INSTRUMENTS, INC.

BIO-TEK[R] INSTRUMENTS, INC.

INTERNATIONAL SAFETY ANALYZER
MODEL 470

OPERATOR'S MANUAL

MANUAL PART NUMBER 4701001

FOR SERIAL NUMBERS 5000 AND UP

PRELIMINARY VERSION, REVISION A

MAY 1989

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1. INTRODUCTION

This manual contains operational information for the Bio-Tek International Safety Analyzer Model 470. A full description of the Model 470 is given, and some guidance on safety testing.

The Model 470 International Safety Analyzer is a portable unit housed in its own carrying case with removable cover and tiltbar. Inside the case, the Analyzer's electronic circuits are contained within a separate metal enclosure. Space is provided for all cables and accessories supplied with the Analyzer.

The Model 470 Electrical Safety Analyzer is suitable for use at virtually any site where electro-medical equipment is located. It may be used, for example, as part of a planned preventive maintenance program (PPM), post service testing, or whenever a safety check is required.

The Model 470 was designed to simplify some of the tests described in IEC 601-1 (BS5724 part 1) by using a program to select the meter full-scale deflection on the unit under test (UUT). This enables a rapid safety check to be carried out without reference to the Standard.

Applications for the Model 470 are not exclusive to IEC 601-1 because many of the parameters and limits which can be checked are common to other safety specifications.

1.2 Specifications

1.2.1 Ranges.

AC + DC Current (True RMS)	10uA, 50uA, 100uA 500uA,1000uA, 5000uA.
Earth Continuity	0 - 5 ohms
Insulation resistance	0 - 50 megohms
AC Volts	0 - 399 VAC

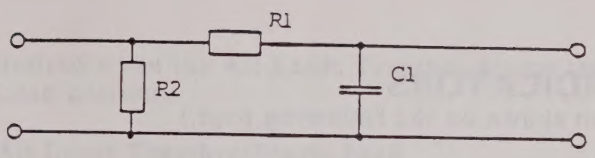
The range in use is indicated by a LED adjacent to the meter.

1.2.2 Accuracy

AC + DC current ranges	± 5% of FSD
Resistance ranges	± 10% of mid-scale
AC Volts	± 5% of FSD

1.2.3 Input characteristics

Measuring Device (MD) as described in IEC 601-1, Figure 15, proposed revision.



R2 is a 1kohm, 1%, 50W non-inductive resistor.
Input filter (R1, C1) - 3dB at 1 kHz.

1.2.4 Input overload rating.

Not greater than 100VAC, or DC should be applied across the Hi and Lo terminals of the Measuring Device.

1.2.5 Temperature Ranges

Operating	10° C to 30° C,	RH less than 80%
Storage	0° C to 50° C,	RH less than 90%

1.2.6 Input overload trips.

i) A voltage of greater than 90 volts across R2 of the measuring device will cause power to be removed from the UUT socket, the DANGER LED will be lit.

ii) An input current which produces a meter deflection in excess of 120% of FSD will cause power to be removed from the UUT socket, and the OVERLOAD LED will be lit.

The overload trips may be reset by turning the main selector switch to the next position and back.

1.2.7 UUT Power Outlet

Power outlet type: A high quality socket is fitted, suitable for the local supply.

Power outlet rating: 1200 VA maximum

NOTE: exceeding this power rating may cause damage to the electrical safety tester.

1.2.8 Dimensions 470 mm x 320 mm x 175 mm, 18.5"x12.6"x6.9"

1.2.9 Weight 13.15 kg, 29 lbs.

2. CONTROLS AND INDICATORS

(Refer to front panel layout shown on the following page.)

2.1 POWER Switch

A latching push switch, illuminated green when in the ON position. It controls power to the tester and the UUT power socket.

2.2 Test Selector Switch

An eighteen position rotary switch which selects the individual tests in a logical sequence.

2.3 Classification/Type

A six position rotary switch, used to select the required safety test program, according to the Class and Type of the instrument to be tested.

2.4 TEST Switch (White)

A non-latching push switch. Its use is required when the Analyzer sources a test voltage or current. Illuminated when required.

2.5 NORMAL/REVERSE (N/R) Switch

A heavy-duty lever switch with a center off position which enables the live and neutral connections to the UUT power socket to be reversed.

The switch has a mechanical interlock which ensures that the lever movement must pause at the center position, open-circuit.

2.6 Normal/Reverse Lamp

A filament lamp with a white lens fitted above the NORMAL/REVERSE switch. Illuminates at those positions in the test sequence where the Unit Under Test should be checked with both normal and reversed AC power connections.

2.7 Applied Parts to Grd.

A non-latching push switch, lit when its use is required by the test program. Pressing the switch connects the APPLIED PART sockets to earth.

2.8 X10 Switch

A latching illuminated (white) push switch. Operating the switch multiplies the uA scale by a factor of ten; it is lit when depressed.

2.9 LEAD SELECT switch

A five position rotary switch, each position being numbered in line with the adjacent APPLIED PART sockets. It is used to select a measurement from an invidual lead, when required, as indicated by an adjacent yellow LED, or when

desired when the All Leads Together/Single lead switch is in the Single Lead position.

2.10 All Leads Together/Single Lead

A two position screw driver operated slide switch, whose operation is as follows:

All Leads Together: In this position measurement of applied part insulation, patient leakage current, and patient leakage current with mains on the applied part is made with all the leads in parallel.

Single Lead: In this position measurement of applied part insulation, patient leakage current, and patient leakage current with mains on the applied part can be made from a single lead.

Note: i) A red LED is illuminated when the SINGLE LEAD position is selected.

ii) The ALL LEADS TOGETHER switch does not effect measurement of patient auxiliary current.

2.11 Ohms Zero Control

A screw driver operated potentiometer which enables zero ohms to be set for test 5.

To set zero connect the PROBE terminal to the GND terminal with the Clip/Probe lead; depress TEST and adjust the potentiometer to set the meter pointer to the zero line of the ohms scale.

Note: Do not depress TEST for more than 10 seconds at a time.

2.12 TEST LEAD terminal

An insulated screw terminal embodying a 4 mm socket. This terminal provides a direct connection to the Unit Under Test socket protective earth. It is used where an UUT has more than one protective earth, or when independent leakage current measurements are to be made.

2.13 SCALE/LEAKAGE limit indicators

Six yellow LED's which, when illuminated indicate the meter FSD value for the test selected by the Program and Test switches. The indicated meter FSD is also the maximum allowed value for that paramter as described in IEC 601-1.

Notes: i) The meter is scaled 0-100uA and 0 to 500uA, and an appropriate multiplication or division should be made by the operator.

ii) Red Sectors: The maximum allowed values in IEC 601-1 are at 110% of nominal mains voltage, however, the voltage supplied to the UUT may be as low as 90% of the nominal mains

voltage. Therefore a reading in the red sectors requires reference to the local supply voltage to determine if the reading is out of limit.

2.14 RES., INS., and MAINS indicators

Three yellow LED's which when illuminated indicate that the meter is measuring:

RES. resistance in the range 0 to 5 ohms.
INS. insulation resistance in the range 0 to 50 megohms
MAINS. AC supply mains voltage up to 300 VAC.

2.15 DANGER indicator.

A red LED which is illuminated when a voltage of greater than 90 volts appears across the 1000 ohms resistor in the measuring device. Power is automatically removed from the UUT power socket but may be restored by turning the main selector switch to the next position and back to the original position.

2.16 OVERLOAD

A red LED which is illuminated when an attempt is made to measure a current of greater than 120% FSD. Power is automatically removed from the UUT power socket buy may be restored by turning the main selector switch to the next position and back to the original position. Depressing the X10 switch before the power is restored will enable the value of the overloading current to be determined.

2.17 Unit Under Test power socket

A standard power outlet which accepts the power plug from the unit under test.

Note: The maximum power which may be drawn by the unit under test via the UUT power socket is 1200 VA; exceeding this rating may cause damage to the switches and relays within the Electrical Safety Analyzer.

2.18 Fuses

There are four pairs of fuses within fuseholders mounted in the rear side face of the Model 470, plus two internal fuses mounted on the printed circuit board.

The fuses protect the following circuits:

i) T6.3A, 250V, 5 x 20 mm., (note, earlier models had T10A, 250v, 5 x 20 mm fuses). These fuses protect the power switching circuits up to the UUT power socket.

NOTE: These fuses are silica-filled high breaking capacity fuses and on no account should they be replaced by any other type.

ii) Int. Supply 1: T160mA, 250v, 5 x 20 mm. These fuses protect the transformer

which supplies the electrical safety tester's internal supplies.

iii) Int. Supply 2: T50mA, 250 v, 5 x 20 mm. These fuses protect high voltage, and " Mains on applied part" supply transformer.

iv) Int. Supply 3: T400mA, 250v, 5 x 20mm. These fuses protect the earth continuity test supply transformer.

v) Int. fuses: T88mA, 250 v, 5 x 20 mm. These fuses protect the internal low voltage supplies to the tester.

3. OPERATION

This section describes the operation of the electrical safety analyzer. Following the procedures outlined in this section will quickly enable the user to become familiar with the safety tester.

3.1 Set-up

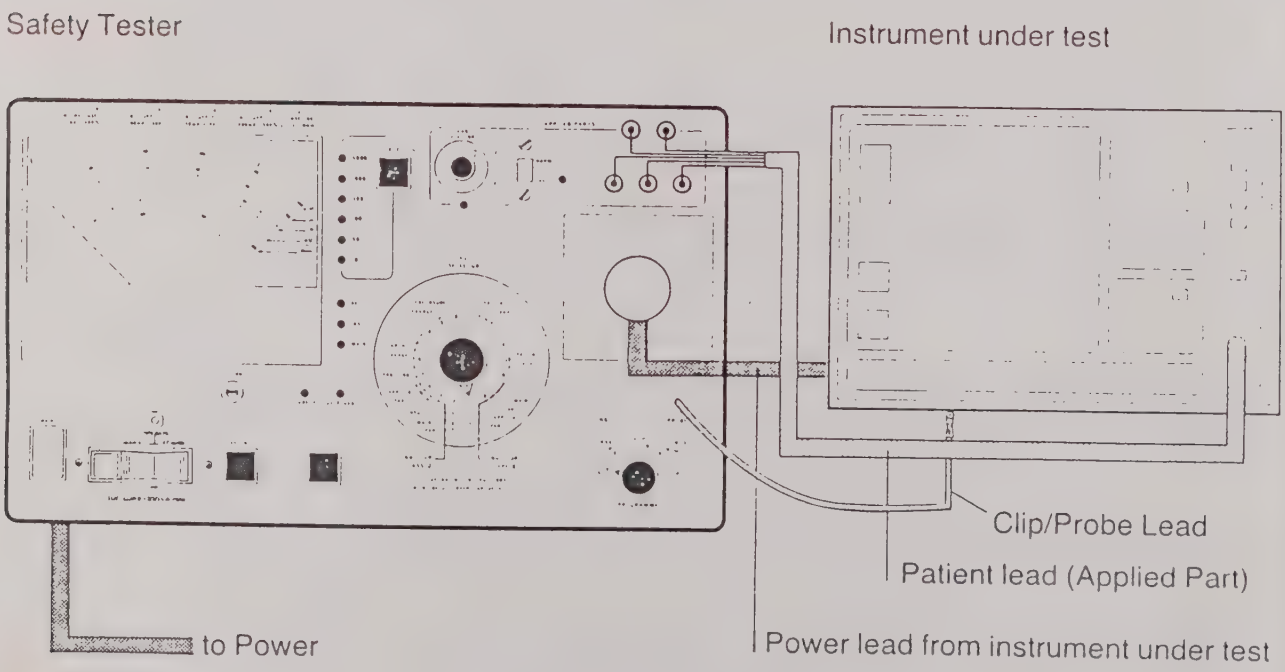
Connecting the Unit Under Test to the Model 470. The Electrical Safety Analyzer should be plugged into a standard power socket with a known good earth.

Before connecting the instrument to be tested, set the test selector switch to test 1, "Test", and the NORMAL/REVERSE switch to the central 'off' position.

The Unit under Test power lead is plugged into the UUT power outlet on the tester.

For example, for a cardioscope, the Applied Part connection is the patient cable which is plugged into the Applied Part sockets at the top right corner of the tester, either directly or via the 4 mm. to crocodile clip adaptors provided.

The clip/probe lead is shown connected to the "Test Lead" terminal on the tester. its use will be described in the appropriate sections.



3.2 Classification/Type

The Classification/Type switch located at the bottom right corner of the tester should be set to the Class and Type of instrument to be tested. For equipment designed to conform to IEC 601-1 the symbols marked on the instrument will enable the Class and Type to be identified as follows:

Class I. There is no symbol for Class 1 equipment, however, Class 1 equipment will generally have a protective earth marked with the symbol:

Class II. Marked with the symbol: It has double or reinforced insulation as the protection against electric shock.

Type B. Marked with the symbol:

It is defined as having a protectively earthed applied part, suitable for internal and external application to the patient, except for direct application to the heart.

Type BF Marked with the symbol:

It is defined as having an F-type isolated (floating) applied part suitable for internal and external application to the patient, except direct cardiac application.

Type CF Marked with the symbol:

It is defined as having an F-type isolated (floating) applied part suitable for direct cardiac application.

For equipment not marked with the symbols shown above, the selection of the test program depends on the operator's knowledge of the equipment to be tested. For example a cardioscope which is known to be protectively earthed, and having an isolated patient circuit with low leakage currents, could be tested as Class 1, Type CF. However, it must be emphasized that this does not classify the cardioscope as Class 1, Type CF, as the classification of equipment depends on a number of important factors of which leakage currents are only one.

3.3. Switch the Instrument under Test ON

All tests are done with the POWER switch and on the unit under Test ON.

3.4 Testing

3.4.1 Test 1. Self Test

Select Test 1,Self TEST, if it has not been previously selected. Switch the Electrical Safety Tester on. The SELF TEST position provides a self-check of the electrical safety analyzer. All lamps are lit and the measuring circuits are connected to an internal reference: the meter needle will indicate within the test arc on the meter scale. Should the tester not perform correctly, the operator should refer to the maintenance section of this manual.

3.4.2 Test 2. Line Voltage

The meter will indicate the value of the local AC mains supply. The 'MAINS' LED next to the meter is lit to indicate the scale to be read.

3.4.3 Test 3. Insulation Resistance, Mains Part.

This test measures the insulation resistance between all parts of the instrument under test which operate at supply mains voltage and the protective earth terminal of the instrument. (500 VDC from a 5 megohm source). A diagram of the test principle is shown in Fig. 1. The Mohm scale is used for this test as indicated by the Ins. Mohm LED adjacent to the meter, and the illuminated test button should be pressed to perform this test.

This test is performed for Class 1 instruments only.

3.4.4 Test 4. Insulation Resistance, Applied Part.

This test measures the insulation resistance between the Appllied Part and the protective earth terminal of the unit under test. (500 VDC from a 5 megohm source). A diagram of the test principle is shown in Fig. 2.

The Mohm meter scale is used for this test as indicated by the adjacent LED and the illuminated TEST button should be pressed to obtain the test voltage. This test is performed for all Class 1 instruments with an applied part, i.e. Class 1, Types BF and CF.

3.4.5 Test 5. Protective Earth

This test measures the resistance of the protective earth system, from the earth pin of the mains plug to all exposed metal parts, for all Class 1 instruments.

The Clip/Test lead is used to probe the exposed metal parts, and it should be held firmly against, or clipped to the metal part before the TEST button is pressed.

As indicated by the adjacent LED the RES. scale is in use, and the illuminated TEST button should be pressed to obtain the test current. A diagram of the test principle is shown in Fig. 3. The test transformer shown in the diagram has a short circuit current of approximately 25 Amps and an open circuit voltage of about 6 volts as described in IEC 601-1.

Note: Some exposed metal parts may not be protectively earthed, this is allowed

provided they are separated from all other circuits by double or reinforced insulation. In cases of doubt the equipment manufacturer should be able to advise.

3.4.6 Test 6. Earth Leakage current - normal condition

This test measures the leakage current flowing in the protective earth conductor of Class I equipment using the Measuring Device described in IEC 601-1, and shown in section 1.2.3.

A diagram showing the test principle is given in Fig. 4. The Unit Under Test's leakage current is measured with the mains power connection normal and reversed. For Types BF and CF instruments the applied part is earthed via the illuminated Applied Part. to Grd. switch to check that this has no significant effect on the leakage current. The limit for all Class 1 instruments is 500 uA; this is indicated by the 500 uA Scale/Limit LED which is lit.

3.4.7 Test 7. Earth Leakge current - Single Fault Condition (SFC) supply open

This test measures the leakage current flowing in the protective earth conductor of Class I equipments with each supply lead interrupted in turn.

A diagram of the test principle is shown in Fig. 4, RL1 is now open. The NORMAL/REVERSE switch is used to interrupt each supply lead in turn, where NORMAL gives liveopen-circuit, and REVERSE gives neutral open-circuit. As above, the illuminated Applied Part to Grd. switch should be used to check that earthing the applied part has no significant effect. The limit for all Class 1 instruments is 1000 uA, as indicated by the adjacent LED.

3.4.8 Test 8. Enclosure Leakage current - normal condition

The Clip/Test lead is used to measure the current which would flow to earth from exposed metal parts which are not protectively earthed. The test principel is shown in Fig. 5, both RL1 and RL4 are closed. This test is carried out for both Class I and Class II instruments and the limits are:

Types B and BF	100 uA
Type CF	10 uA

NOTE:IEC 601-1 calls for enclosure leakage current to be measured from exposed metal parts not protectively earthed, however, it may not be possible to determine which parts are not earthed (but see Test 5 above), therefore, it is recommended the measurement be made from all exposed parts, as earthed metal parts should not source a significant current.

3.4.9 Test 9. Enclosrue leakage current - SFC Earth open

The Clip/Test lead is used to measure the current which would flow to earth from exposed metal parts which are not protectively earthed, i.e. with the protective earth open-circuit. The test principle is shown in Fig. 5. RL1 is closed, and RL4 is open.

This test is carried out for Class 1, Types B, BF and CF only, and the limit is 500 uA.

Notes: i) See note for test B
ii) Exposed metal parts which are normally protectively earthed should source the same leakage current as that found for Earth leakage current normal condition.

3.4.10 Test 10. Enclosure leakage current - SFC supply open

The Clip/Test lead is used to measure the current which would flow to earth from exposed metal parts which are not protectively earthed, with each supply lead interrupted in turn. The test principle is shown in Fig. 5, RL1 is open, and RL4 is closed. The Normal/Reverse switch is used to interrupt each supply lead in turn, where Normal gives live open-circuit, and Reverse gives neutral open-circuit.
This test is carried out for Class 1 and 2, Types B, BF and CF. The limit is 500uA.

Note: See note for test 8.

3.4.11 Test 11. Patient leakage current - normal condition

This test measures the leakage current to earth from the Applied Part, for Class 1 and 2 equipment. The test principle is shown in Fig. 6, both RL1 and RL4 are closed. The current is measured from all parts of the applied part in parallel for Class I, and II types B,and BF and from each part of the applied part for Class I, and II, Type CF. The limits are:

Type B and BF 100 uA
Type CF 10uA per part of the Applied Part.

Notes: i) To measure from individual parts of the Applied Part to earth, set the All Leads Together/Single Lead switch to Singel Lead, and operate the Lead Selector switch.

ii) Operate the Normal/Reverse switch.

3.4.12 Test 12. patient leakage current -SFC Earth open

This test measures the leakage current to earth from the Applied Part, for Class 1 equipment with the earth open-circuit. The test principle is shown in Fig. 6, RL1 is closed, and RL4 is open.

The limits are: Type B and BR 500uA
Type CF 50 uA per part of the Applied TEST

Notes: i) To measure the current to earth from individual parts of the Applied Part, set the All Leads Together/Single lead switch to Single Lead , operate the Lead Selector switch.

ii) Operate the Normal/Reverse switch.

3.4.13 Test 13. Patient leakage current - SFC Supply Open

This test measures the leakage current to earth from the Applied Part for Class 1 and Class 2 equipment with each supply lead interrupted in turn.

The test principle is shown in Fig. 6, RL1 is open, and RL14 is closed. The NORMAL/REVERSE switch isused to interrupt each supply lead in turn, where Normal gives Live open-circuit and Reverse gives Neutral open-circuit.

The limits are: Type B and BF 500uA.
Type CF 50 uA per part of the applied Part.

Note; To measure from individual parts of the Applied Part set the All Leads Together/Single Lead switch to Single Lead and operate the Lead Selector switch.

3.4.14 Test 14. Patient Auxilliary current - Normal condition

This test measures the current flowing between any single patient connection and all other patient connections connected together, for both Class 1 and Class 2 equipment. The test principle is shown in Fig. 7, both RL1 and RL4 are closed.

The limit for types B, BF, and CF is 10uA.

Notes: i) operate Normal/Reverse switch
ii) operate Lead Selector switch.

3.4.15 Test 15.Patient Auxiliary Current-SFC Open Earth

This test measures the current flowing between any single patient connection and all other patient connections connected togther with the earth open circuit,for Class I equipment only. The test principle is shown in Fig. 7, RL1 is closed ,and RL4 is open. The limits are:

Type B and BF 500 uA
Type CF 50 uA

Notes: i) operate Normal/Reverse switch
ii) operate Lead Selector switch.

3.4.16 Test 16. Patient Auxiliary Current - SFC Supply Open

This test measures the current flowing between any single patient connection and all other patient connections connected together, with each supply lead interrupted in turn, for both Class I and Class II equipment.

The test principle is shown in Fig. 7. RL1 is open circuit, and RL4 is closed. The Normal/Reverse switch is used to interrupt each supply lead in turn, where Normal gives live open-circuit and Reverse gives neutral open-circuit.

The limits are: Type B and BF 500uA
Type CF 50uA.

Note; Operate Lead Select switch.

3.4.17. Test 17. Mains on Applied Part.

This test measures the current which would flow into an isolated Applied Part if mains volts were present at the input, for both Class 1 and Class 2 equipment. The test principle is shown in Fig. 8.

The limits are: Type BF 5000 uA
Type CF 50uA.

Notes: i) Press 'TEST' to apply voltage to the Applied Part.
ii) Operate Normal/Reverse switch.

3.4.18 Test 18. Mains on Applied Part.

This test measures the current which would flow into an islolated applied part if mains voltage phase reversed relative to TEST 17 ,for both Class I and Class II equipment. the test principle is shown in Fig.8 with the phase reversal relay operated. The limits are : Type BF 5000uA
Type CF 50uA

Notes: i) press 'Test' to apply voltage to the Applied Part.
ii) operate Normal/Reverse switch.

3.5 Tester Test Plug.

The tester test plug is provided to enable some simple checks to be made on the Electrical Safety TEster in addition to the self-check at Test 1.

The values given in the table below are subject to variation with mains voltage, therefore, a normal range is given.

Fit Test Plug with flying lead connected to AP socket No.3 and set Lead Selector to No.3 and select Class II,Type CF.

Test	Reading
3	1 megohm 15%
4	10 megohms 15%
5	N/A
6	90uA - 140 uA
7	160/0 uA - 230/0 uA.
8,9,10,11	N/A
12	8uA - 13 uA
13,14,15,16	N/A
17,18.	20uA - 30 uA

3.6 Special Test with the Bio-Tek Model 470.

3.6.1 Measurement of enclosure leakage currents between 2 conductive parts of an instrument:

-use test selector positions 14, 15,16 instead of 8,9,10
-connect extra measuring leads to AP sockets 2 and 4
-set AP switch to position 2 or 4
-for type B/BF: use "Scale X10" in test 14
-for type CF: use "scale X10" in test 15,16.

3.6.2 Use as an independent uA or mV meter with IEC 601-1 load:

-connect extra measuring leads to AP sockets 2 and 4
-set AP switch to position 2 or 4
-set following switches depending on desired range:

Range	Test Selector	Class/Type	"Scale X10"
10 uA/mV	14	no effect	normal
50 uA/mV	15	CF	normal
100 uA/mV	14	no effect	X10
500 uA/mV	15	CF	X10
5000 uA/mV	15	B/BF	X10

3.6.3 Use as an independent (ground) continuity tester with 10-25 Amp. tester current.

-set test selector to position 5
-use clip/prove lead supplied, connected to probe terminal, and set electrical zero
-connect an extra probe lead of proper current capacity to "Ground" terminal
-measure resistance of extra lead and note value
-connect probes to unknown resistance
-depress "Test" button, note reading
-subtract extra probe lead resistance to obtain true reading.

4.0 Preventative Maintenance Program

On the following page you will find a copy of the Test Form that can be used in conjunction with the 470. This form allows you to keep a record of the testing that has been performed and monitor the readings from one interval to the next.

Use the copy in this manual as a master for duplication.

5.0 Service

If service of your Model 470 is required please contact our service department for details.

Service Department
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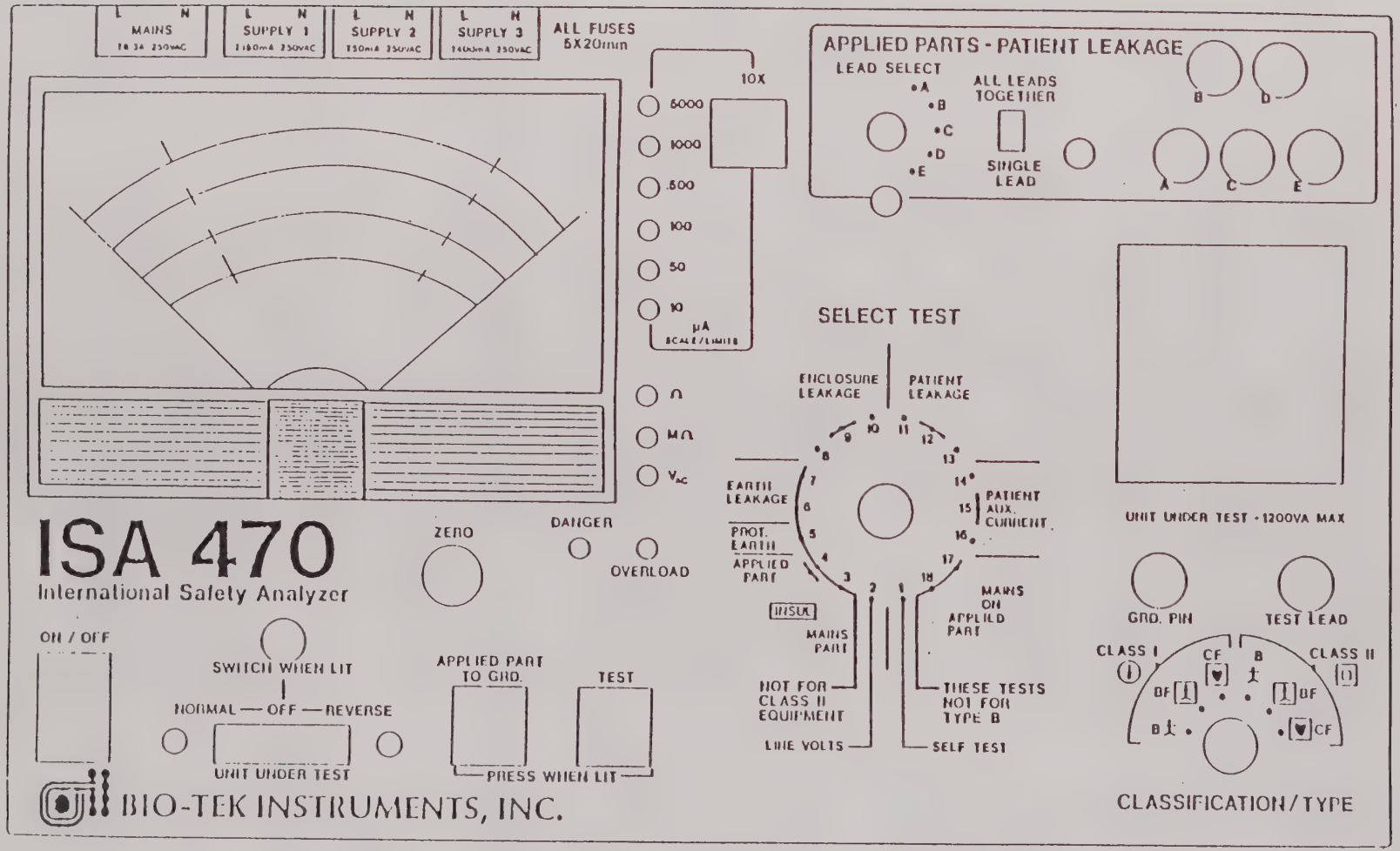
Highland Park ,Box 0998
Winooski,Vermont 05404-0998

Phone: 802-655-4040
Telex: 94-0136 BIO TEK SHVT
Fax: 802-655-7941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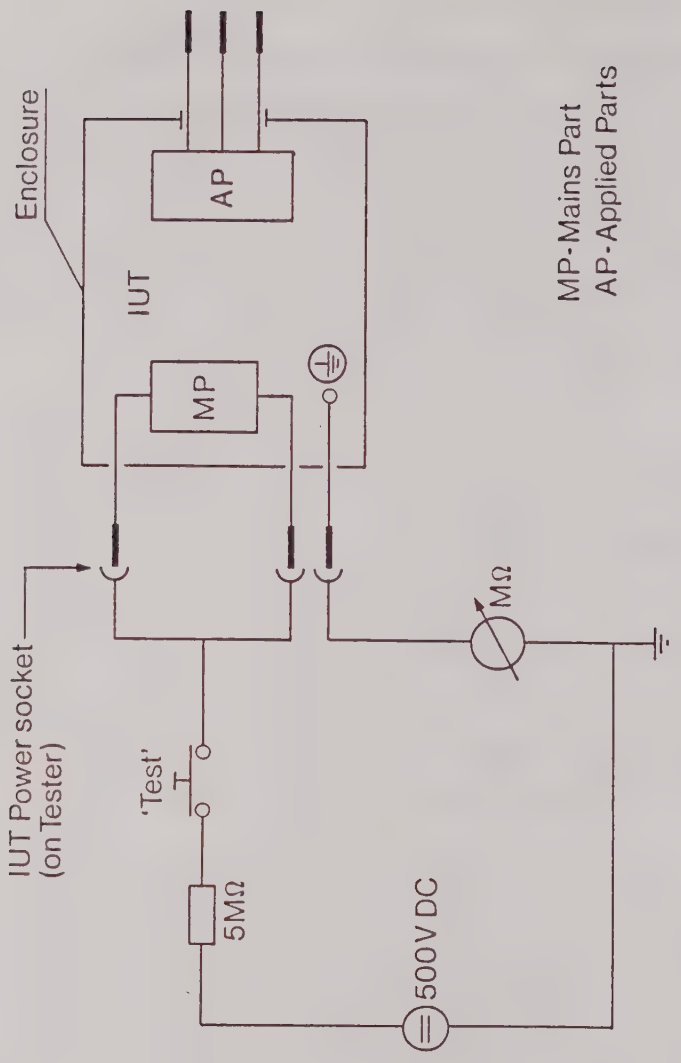
MAINS
L N
SUPPLY 1
L N
SUPPLY 2
L N
SUPPLY 3
ALL FUSES
5X20mm
10X
6000
1000
500
100
50
10
µA
Ω
MΩ
VAC
APPLIED PARTS - PATIENT LEAKAGE
LEAD SELECT
A
B
C
D
E
ALL LEADS TOGETHER
SINGLE LEAD
B
D
A
C
E
SELECT TEST
ENCLOSURE LEAKAGE
PATIENT LEAKAGE
EARTH LEAKAGE
PROT. EARTH
APPLIED PART
PATIENT AUX. CURRENT
MAINS ON APPLIED PART
INSUL
MAINS PART
NOT FOR CLASS II EQUIPMENT
LINE VOLTS
THESE TESTS NOT FOR TYPE B
SELF TEST
UNIT UNDER TEST - 1200VA MAX
ISA 470
International Safety Analyzer
ZERO
DANGER
OVERLOAD
ON / OFF
SWITCH WHEN LIT
NORMAL — OFF — REVERSE
UNIT UNDER TEST
APPLIED PART TO GRD.
TEST
PRESS WHEN LIT
GRD. PIN
TEST LEAD
CLASS I
CF
B
CLASS II
BF
BF
B
CF
BIO-TEK INSTRUMENTS, INC.
CLASSIFICATION/TYPE

Electrical Safety Test Record

Equipment: Serial No:

Class: Type:

Test No.												
	Test Date →											
2	Mains Volts											
3	Ins. MΩ	Mains part.										
4		Applied pa.										
5	Earth Cont. Ω											
6	Earth Leakage μA.	Normal	N									
			R									
7		Supply o/c	N									
			R									
8	Enclosure Leakage μA.	Normal	N									
			R									
9		Earth o/c	N									
			R									
10		Supply o/c	N									
			R									
11	Patient Leakage μA.	Normal	N									
			R									
12		Earth o/c	N									
			R									
13		Supply o/c	N									
			R									
14	Patient Auxiliary μA.	Normal	N									
			R									
15		Earth o/c	N									
			R									
16		Supply o/c	N									
			R									
17	Mains on AP. μA.	Mains N	N									
			R									
18		Mains R	N									
			R									



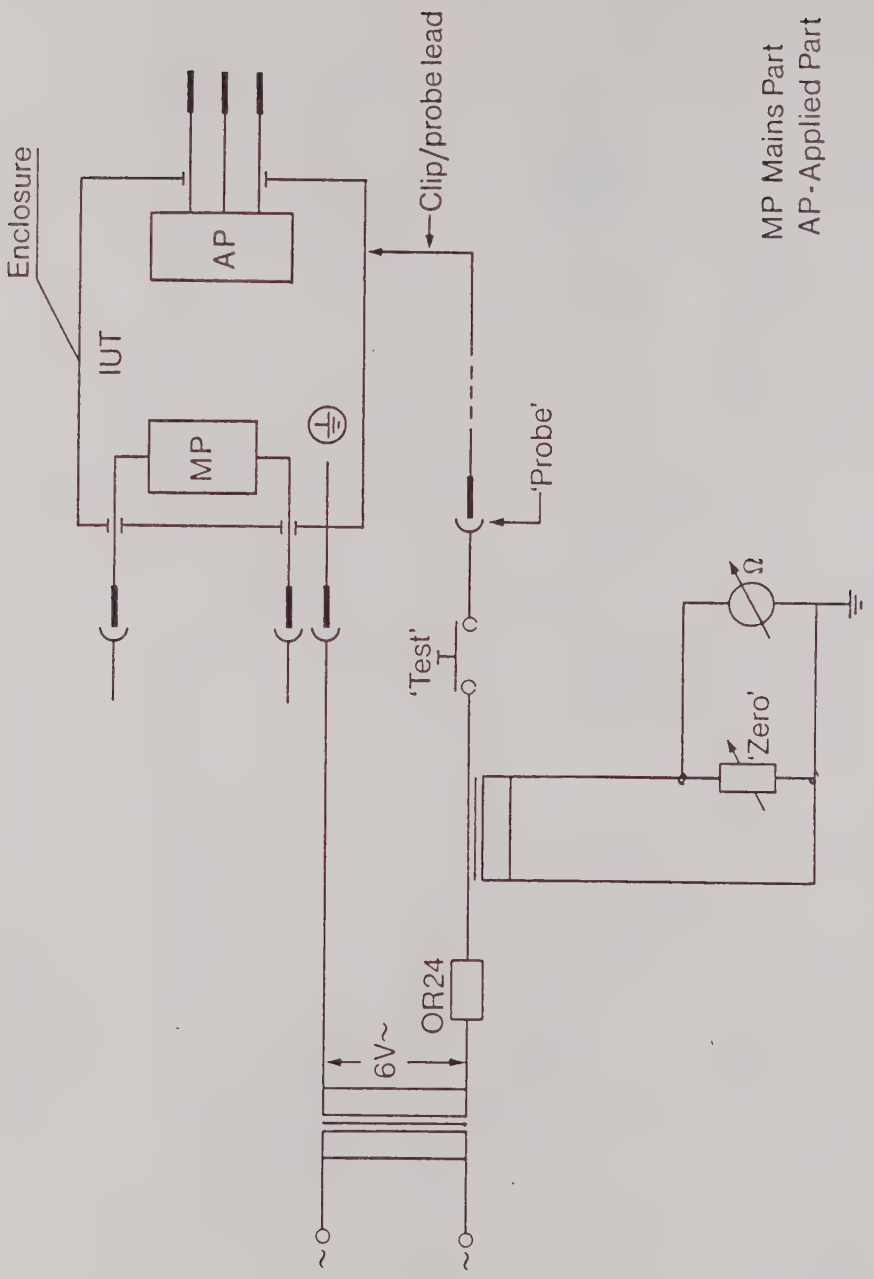
Applicable to: Class1, Type B, BF and CF
Note: Press TEST to apply test voltage

Test Principle; Test 3, Insulation Resistance, Mains Part.

Applicable to: Class1, Types BF and CF

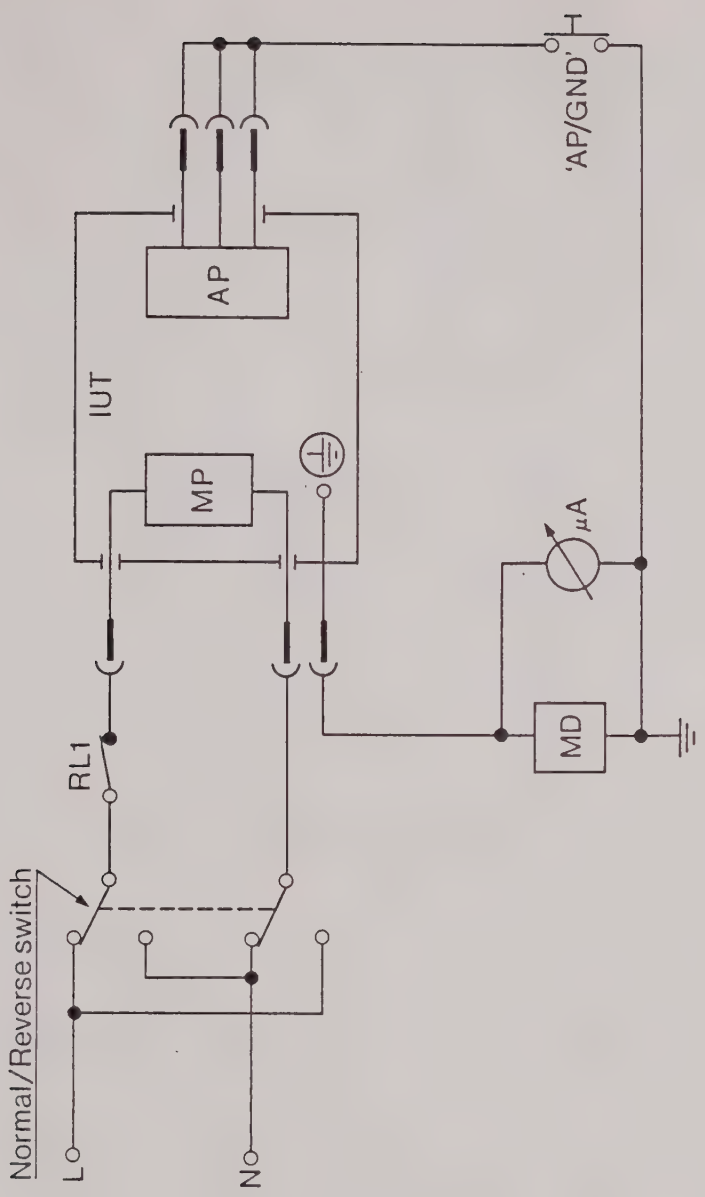
Note: Press TEST to apply test voltage

Test Principle; Test 4, Insulation Resistance, Applied Part



Applicable to: Class1, Types B, BF and CF
Limit: OR2, including the Mains Lead
Notes: Press TEST to apply test current
Probe all exposed metal parts on IUT

Test Principle; Test 5, Earth Continuity



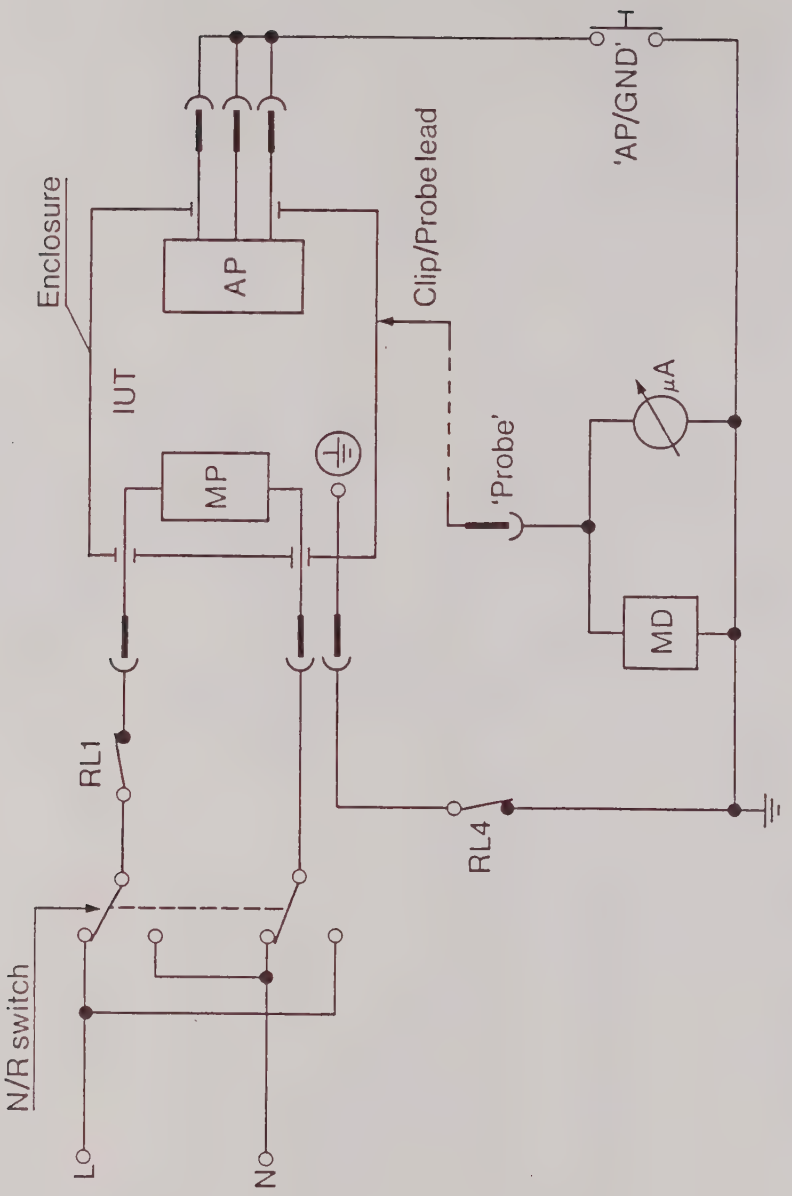
MP-Mains Part
AP-Applied Part
MD-Measuring Device

Applicable to: Class 1, Types B, BF and CF

Limits: Test 6, 500μA
Test 7, Single Fault Condition (SFC) RL1 open, 1000μA

Notes: Operate Normal/Reverse (N/R) Switch
Operate AP/GND switch for BF and CF

Test Principle; Tests 6 and 7, Earth Leakage Current

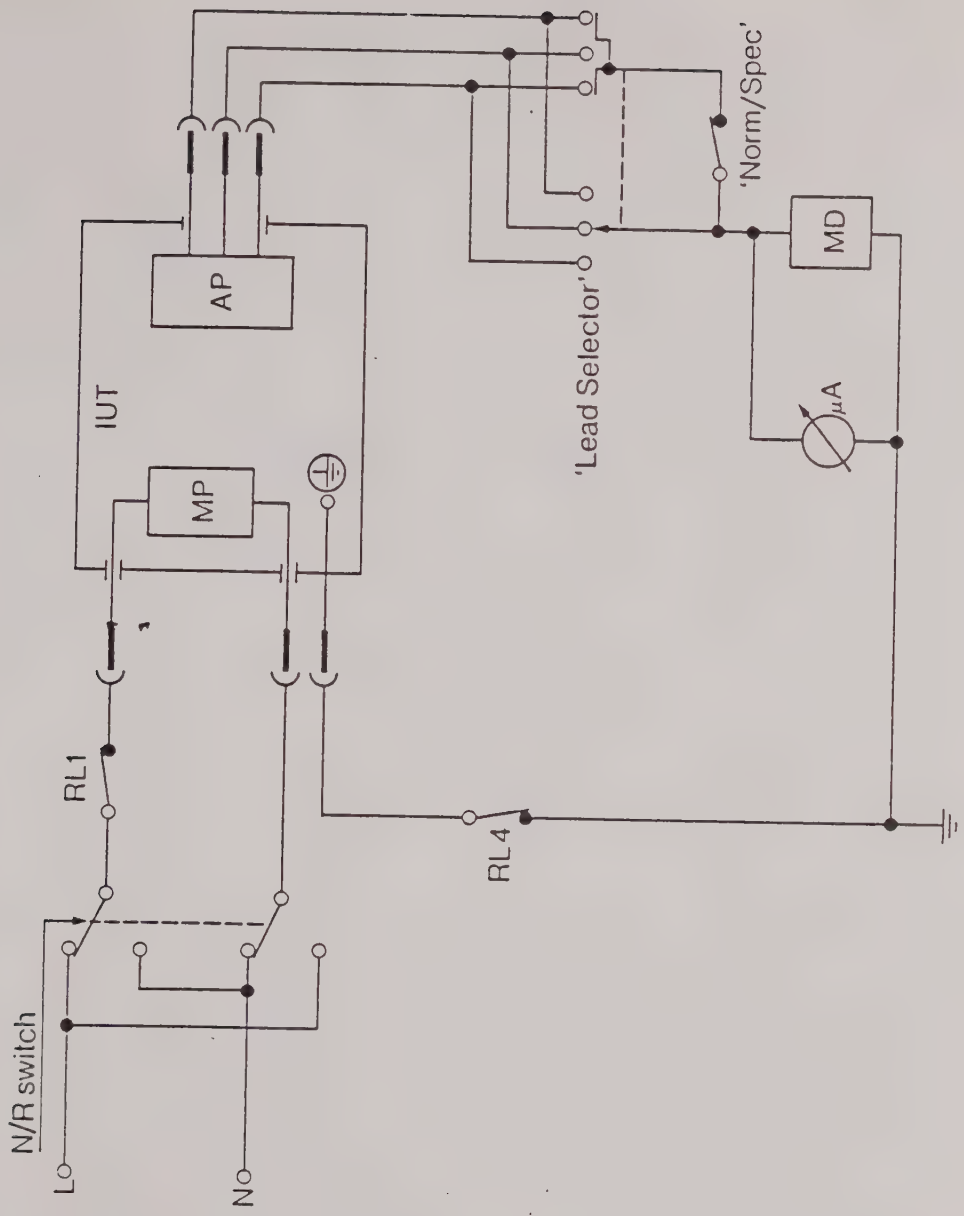


Applicable to: Tests 8 and 10; Classes 1 and 2, Types B, BF and CF
Test 9; Class 1, Types B, BF and CF

Limits: Test 8 - Types B and BF 100μA, Type CF 10μA
Test 9 - SFC (RL 4 open) all Types 500μA
Test 10 - SFC (RL 1 open) all Types 500μA

Notes: Operate N/R switch and AP/GND switch for BF and CF
Probe exposed metal part

Test Principle; Tests 8,9 and 10 Enclosure Leakage Current

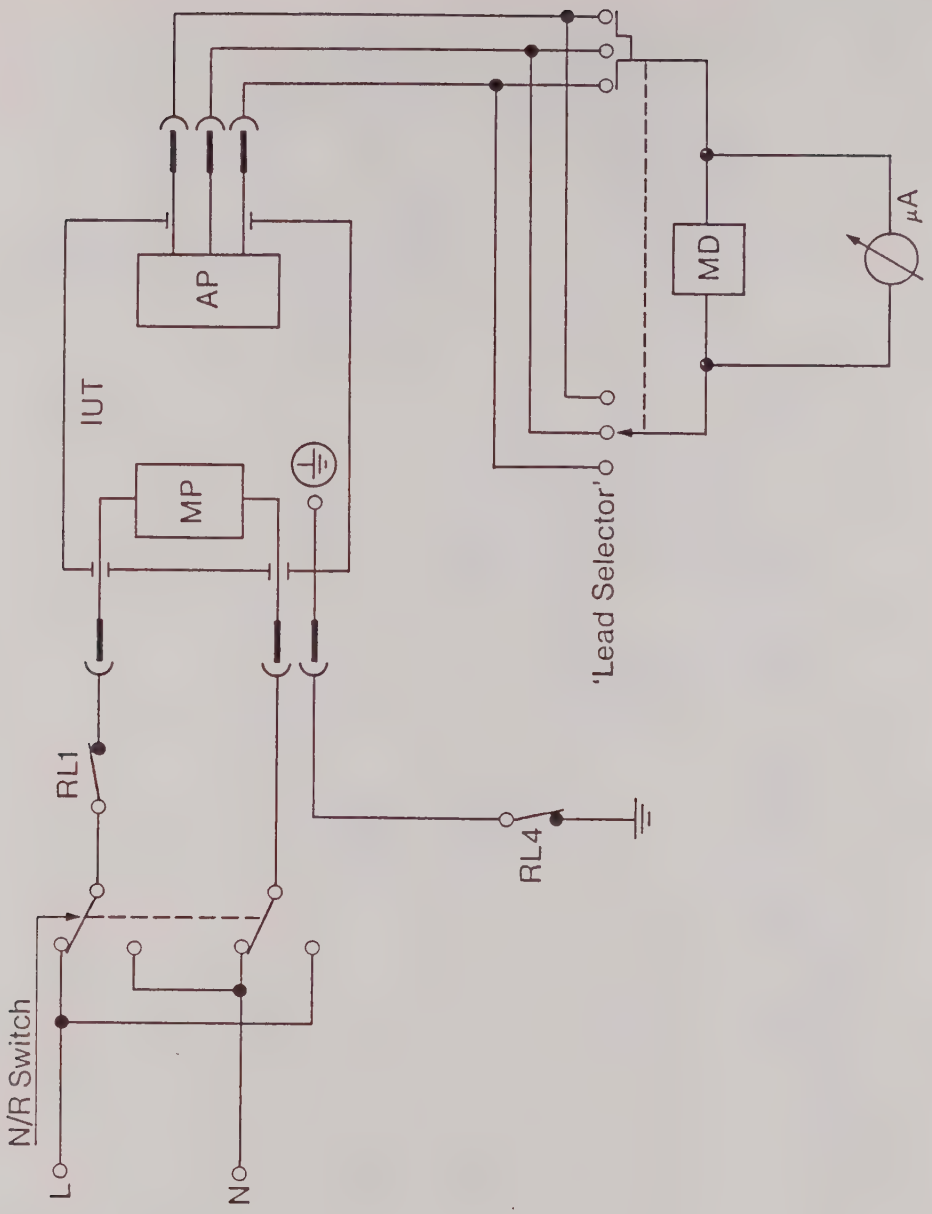


Applicable to: Tests 11 and 13, Classes 1 and 2, Types B, BF and CF
Test 12, Class 1, Types B, BF and CF

Limits: Test 11, Types B and BF 100μA
Type CF 10μA per part of the AP
Test 12, Types B and BF 100μA
Type CF 50μA per part of the AP
Test 13 as test 12

Note: Set Norm/Spec switch to Spec for Type CF

Test Principle; Tests 11,12 and 13 Patient Leakage Current

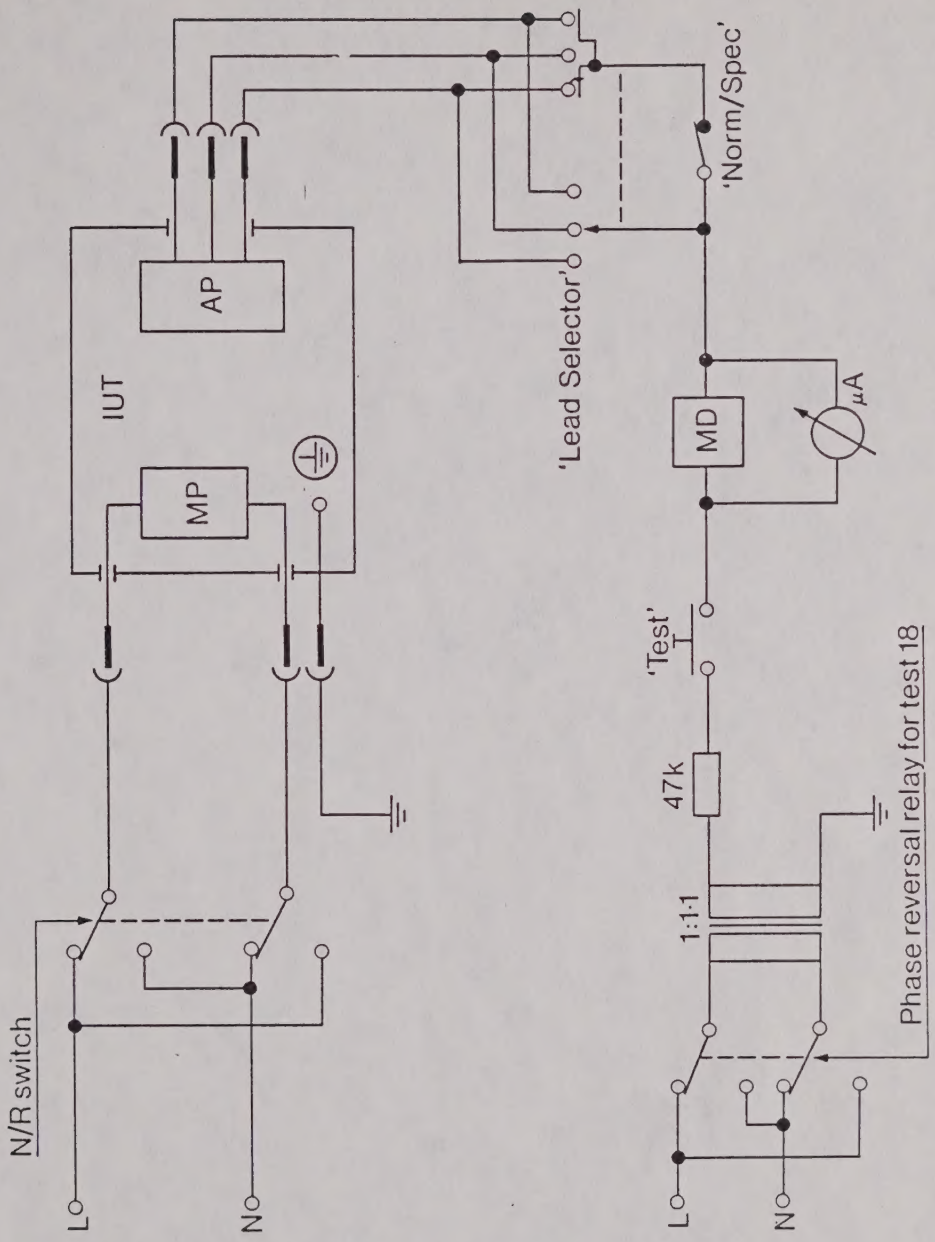


Applicable to: Tests 14 and 16. Classes 1 and 2, Types B, BF and CF
Test 15, Class 1, Types B, BF and CF

Limits: Test 14, Types B, BF and CF 10μA
Test 15, SFC (RL4 Open), Types B and BF, 500μA
Type CF, 50μA
Test 16, SFC (RL1 Open), Types B and BF, 500μA
Type CF, 50μA

Notes: Operate N/R switch
Operate Lead Selector switch

Test Principle; Tests 14, 15 and 16 Patient Auxiliary Current



Applicable to: Classes 1 and 2, Types BF and CF

Limits: Type BF 5000µA
Type CF 50µA per part of the AP

Notes: Operate N/R switch
Set Norm/Spec switch to Spec for Type CF

Test Principle; Tests 17 and 18 Mains on Applied Part

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